THURSDAY, NOVEMBER 20, 1890.

KOCH'S CURE FOR CONSUMPTION.

DURING the last week Koch has made a further communication regarding his treatment of tuberculosis, which has been received with intense interest and perhaps with a certain amount of disappointment. For he has described his mode of applying the new remedy with sufficient accuracy to allow medical men to use it in the treatment of their patients, but he has left us still completely in the dark regarding the nature of the remedy itself.

A certain quantity of the remedy can be obtained from Dr. Libbertz, who has undertaken its preparation with the co-operation of Dr. Koch himself and Dr. Pfühl, but their stock is at present small, and larger quantities will not be obtainable for some weeks. In exercising this reserve regarding the nature of the remedy he employs, Dr. Koch has probably done very wisely, for it is evident that the substance he uses is very powerful and any inaccuracy or imperfection in its preparation might prove injurious to patients, and bring discredit upon the mode of treatment.

The remedy is a brownish, transparent fluid which is much too strong for use until it has been largely diluted with water. The diluted solution is applied by subcutaneous injection. There is a remarkable difference between the action of this remedy upon guinea-pigs, healthy men, and phthisical patients. Two cubic centimetres of the undiluted liquid produces no sensible effect when injected under the skin of a guinea-pig ; but, calculated by body weight, the fifteen-hundredth part of this quantity produces cough, difficulty of breathing, sickness, vomiting, and fever, lasting for about twelve hours, in a human being. The presence of tubercle in the organism appears to render it extremely susceptible to the action of the remedy, for while the hundredth part of a cubic centimetre, *i.e.* one twenty-fifth part of the dose just mentioned as producing fever in healthy subjects, has no effect upon them, it will cause high fever along with coughing and sickness in tuberculous patients. Nor is this to be wondered at, for the remedy exerts its action upon the tissues which have been infiltrated by the tubercle bacillus and not upon the bacillus itself. It causes these tissues to die and be thrown off along with the bacilli they contain. This process is accompanied by fever, which the dose of the remedy used would not produce in health. In consequence of this the remedy may be used as a means of ascertaining the presence of tuberculosis as well as of curing it. If it causes more fever than it ought to do, in a doubtful case of phthisis, the presence of tubercle may be assumed, and when it ceases to produce fever in a patient under treatment the cure may be regarded as well-nigh complete. The effect of the remedy upon the diseased tissues can be seen in cases of lupus, where the tubercle bacillus infiltrates the skin instead of attacking the lungs as it does in consumption. A few hours after the remedy has been injected into the skin of the back, the spots of lupus on the face, far away from the seat of the injection, begin to swell and redden, and then become brown and dead, while the healthy tissue around becomes red and inflamed. The spots then become converted into dry crusts, which fall off in one or two weeks, leaving a clean red cicatrix behind. This result is very much like that produced by the direct application of a strong arsenical paste to the lupus spots. The tubercle bacilli weaken the vitality of the tissues which they infiltrate. The arsenic finishes the process they have begun, and kills the weakened tissues altogether, while it does not destroy the healthy tissues, and the once diseased but now dead part withers up and falls away from the living and healthy parts around. But arsenic can only do this when applied to the lupus in quantities sufficient to poison the patient many times over if it were absorbed into the blood, and consequently is quite out of the question as a cure for tuberculosis. Koch's remedy, on the other hand, seems to seek out tubercular tissue wherever it may be, and almost certainly produces changes in tubercular lungs and joints similar to those in lupus spots, although its action cannot be seen in the former as it can be in the skin. The fact that the new remedy does not destroy the tubercle bacilli, but only the tissues in which they are embedded, is distinctive of Koch's new method, which promises to effect a radical change in the treatment, not only of tubercle, but of many other diseases.

Since the discovery by Metschnikoff six years ago that the cells of the blood and tissues can eat up and digest the bacilli which constitute the germs of many diseases, the view has been constantly gaining ground that recovery or death in infective diseases is simply a question of the victory of the cells of a living organism or of the bacilli by which they have been attacked. In seeking for methods of cure men have tried either to find a way to weaken and destroy the bacilli, or to strengthen the resisting power of the tissues. When an organism is attacked by a new disease, it succumbs like an untrained army in the presence of an enemy. But the tissues appear to acquire a power of resistance, and if the first attack be recovered from, the organism is in many instances insusceptible to subsequent infection, as is shown in the case of small-pox, whether this has been accidentally acquired or intentionally inoculated. But an army may be trained to military tactics by sham fights instead of actual warfare, and the cells of an organism may become endowed with the power of resisting any infection, however virulent, by successive inoculations of a virus, weak at first but gradually increasing in power. This was the plan followed by Pasteur in his inoculations for anthrax. In these he employed at first anthrax bacilli so weakened by cultivation in an unfavourable medium that they produced nothing more than a slight indisposition, and then a virus less and less weakened until the virus of full strength could be successfully resisted. This process was one of protection rather than cure, but in his researches on rabies Pasteur turned his genius to the discovery of a means of cure. As he informed the Commission which went from this country to report on his method, he was himself not exactly aware how he arrived at his mode of treatment, but the conclusion had formulated itself in his mind that the disease produced a substance which was a protective against its own action. The treatment which he based on this conclusion has been so successful as to lead to many attempts to

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separate disease-germs and protective. These attempts have hitherto been fruitless in the case of rabies, but have been successful in other diseases. By cultivating disease-germs in a suitable liquid, and afterwards killing the germs themselves by heat, or removing them by filtration through porcelain, solutions have been obtained quite free from germs, and containing only the substances they have formed during their life and growth. Such solutions have been shown by M. Pasteur's pupils and others to have the power of protecting from septicæmia, anthrax, typhoid fever, and diphtheria; and Prof. S. Dixon, of Philadelphia, has succeeded in rendering animals resistant to inoculation with tubercle by previously inoculating them with the products of growth of the tubercle bacillus.

Most interesting experiments on the nature of these protective substances have been made by Wooldridge, Hankin, and Sydney Martin, who have shown that they are probably either globulins or albumoses rather than alkaloids, although Martin has obtained an alkaloid which produces all the symptoms of anthrax, and possibly may protect against it.

Koch's direction that his new remedy is to be prescribed under the name of paratoluid seems to indicate that it belongs to a class of bodies more nearly akin to alkaloids than to albumoses. Para-acet-toluid has been investigated by Jaffe and Hilbert, and found, like Koch's remedy, to be innocuous to the lower animals. It is possible that the new remedy may belong entirely to that class which has furnished us lately with so many valuable antipyretics and analgesics. But it seems more probable that it consists partly at least of a lymph containing the products generated by some microbe. One's first thought would naturally be that the substances formed by the tubercle bacillus itself would be chosen by Koch for curative as they have been by Dixon for protective purposes. But tubercle differs much from many other infective diseases, for anthrax, typhus, scarlet fever, or measles, run a definite course, and if they do not kill the patient at once, they protect him from a subsequent attack. But the attack of hectic fever which daily recurs in a patient suffering from phthisis confers no protection on him at all, but rather hastens the progress of the disease to a fatal termination.

The case is sometimes different when disease due to another microbe attacks a patient suffering from some form of tuberculosis. Thus lupus has been seen to shrivel and die after an attack of erysipelas or measles, and peritonitis, supposed to be tubercular, has disappeared during recovery from diphtheria. Judging from the resemblance between the effects of Koch's remedy and those of erysipelas, measles, or diphtheria, we should be inclined to suppose it to consist of a filtered culture of the germs of one of these or of some such infective disease, probably mixed with some kind of paratoluid.

It may perhaps seem idle to speculate on the composition of a remedy which its discoverer will probably describe fully ere long, but it must be remembered that tuberculosis, though one of the most frightful scourges of mankind, is not the only ill that flesh is heir to. There are others, with a less mortality perhaps, but even more feared by the sufferers themselves, and we may trust that the lines of research just indicated, whether they be exactly those on which Koch has been working or not, may lead to the discovery of certain cures for scarlet fever, diphtheria, gummata, and that most dreaded of all—cancer.

T. L. B.

THE CHEMISTRY OF IRON AND STEEL MAKING.

The Chemistry of Iron and Steel Making. By W. Mattieu Williams, F.C.S., F.R.A.S. (London: Chatto and Windus.)

THIS work differs materially from the ordinary technological text-books with which we are so familiar. Throughout it is evident that the author has thoroughly utilized his varied experience and great ability to their fullest extent, resulting in the production of a mass of suggestive information valuable to the ordinary student, and affording matter for reflection, even to those who have for years made the chemistry of iron and steel a specialty.

The introductory portion of the work is interesting, but chiefly briefly historical; the same may be said as regards chapter ii., on the ores of iron, which includes some speculations on the possible meteoric origin of iron. The wide diffusion of iron in the form of dust is quoted as indicating in part at least the meteoric origin of the metal.

Chapters iii. and iv., on reduction and dissociation, fluxing, roasting, and calcination, are thorough, giving concisely and forcibly the necessary knowledge in a manner well worthy of imitation in more pretentious works. The author's study on the analogy of dissociation to evaporation, commencing with water, followed by illustrations of the dissociation of the metals from their oxides, &c., shows that he not only clearly understands his subject, but also has the faculty of communicating his ideas clearly to others.

It is difficult to do justice to chapters v. and vi., on the blast-furnace, without entering into details which would here be out of place. The descent of the charge in the blast-furnace is first discussed, and the importance of clear ideas as regards the *rationale* of blast-furnace charging is insisted upon. It is not a simple process: (1) the heterogeneous impurities of the ore have to be removed; (2) the iron must be reduced to the metallic state; (3 and 4) the reduced metallic iron must be fused, as also the earthy impurities. All must proceed in due sequence. A definite statement of the problem of modern iron smelting must be before us ere we can follow rationally the reactions which occur. The evolutionary process from the old bloomeries or Catalan forge, next the small blast-furnace up to the huge structures of to-day is clearly set forth. Credit is also given to the practical worker, who, the author acutely remarks, must have possessed more practical scientific knowledge than we have been inclined or able to perceive.

The apparent irrationality of the modern system of smelting, by which iron ore is not only reduced to the metallic state, but the resultant metal becomes loaded with silicon and carbon, &c., is fairly discussed. It is shown that although what is termed the direct process, *i.e.* the simple reduction of the metal from its oxide, may be so conducted as to produce a nearly pure wrought iron, yet such methods are not economical, and are of limited application.

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